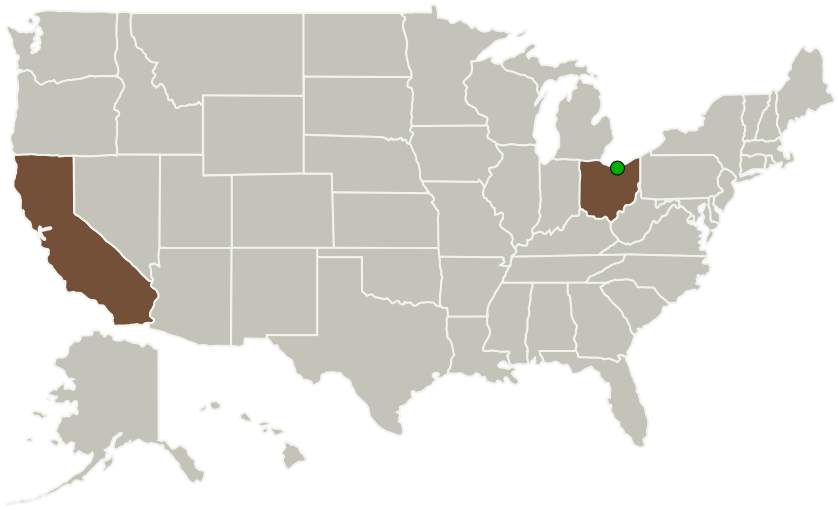
Low-Cost, High-Performance Combustion Chamber for LOX/CH4 Propulsion, Phase I

Completed Technology Project (2010 - 2010)

Project Introduction

Ultramet will design and fabricate a lightweight, high temperature 5-lbf combustion chamber for use with cryogenic liquid oxygen/methane (LOX/CH4) propellant that will deliver a specific impulse of ~355 seconds, an increase over the current 320-sec baseline that will result in a propellant mass decrease of 55 lbm. The material system will be based on Ultramet's proven oxide-iridium/rhenium architecture, which has been successfully hot-fire tested with stoichiometric oxygen/hydrogen for hours. Instead of rhenium, however, the structural material will be a niobium alloy that has excellent high temperature yield strength. With a yield strength-to-weight ratio over 33% greater than that of rhenium at elevated temperature, this niobium alloy will significantly reduce chamber weight. The starting materials are two orders of magnitude less expensive than rhenium and are less expensive than the C103 alloy commonly used in low-performance engines. Aerojet will design the chamber in Phase I and will perform hot-fire testing in Phase II. Phase II will include scaleup of the process and testing of a chamber in the 25- to 500-lbf thrust class, which would be suitable for a reaction control system engine on a lunar ascent/descent vehicle.

Primary U.S. Work Locations and Key Partners



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Small Business Innovation Research/Small Business Tech Transfer

Low-Cost, High-Performance Combustion Chamber for LOX/CH4 Propulsion, Phase I

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Organizations Performing Work	Role	Type	Location
Ultramet	Lead Organization	Industry	Pacoima, California
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
California	Ohio

Project Transitions

January 2010: Project Start

July 2010: Closed out

Closeout Summary: Low-Cost, High-Performance Combustion Chamber for LOX/CH4 Propulsion, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/140626)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Ultramet

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

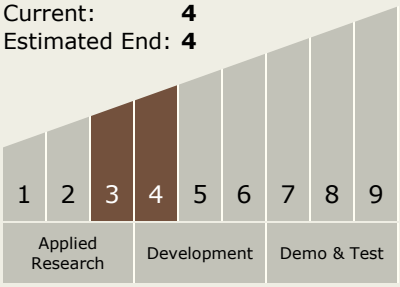
Carlos Torrez

Principal Investigator:

Arthur J Fortini

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Completed Technology Project (2010 - 2010)

Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.3 Cryogenic

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System